

Acceptance of Direct Physician Access to a Computer-Based Patient Record In a Managed Care Setting

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Kaiser Permanente Mid-Atlantic States has developed a fully integrated outpatient information system which currently runs on an IBM ES9000 on a VM platform written in MUMPS. The applications include Lab, Radiology, Transcription, Appointments, Pharmacy, Encounter tracking, Hospitalizations, Referrals, Phone Advice, Pap tracking, Problem list, Immunization tracking, and Patient demographics. They are department specific and require input and output from a dumb terminal. We have developed a physician's work station to access this information using PC compatible computers running Microsoft Windows and a custom Microsoft Visual Basic 2.0 environment which draws from these 14 applications giving the physician a comprehensive view of all electronic medical records. Through rapid prototyping, voluntary participation, formal training and gradual implementation we have created an enthusiastic response. 95% of our physician PC users access the system each month. The use ranges from 0.2 to 3.0 screens of data viewed per patient visit. This response continues to drive the process toward still greater user acceptance and further practice enhancement.

INTRODUCTION

The conventional wisdom of our institution circa 1990 held that physicians do not use computers because the learning curve was too long, the process was demeaning to them and the accuracy of the input was suspect. Some of these opinions were supported in the literature. [1] In their homes many of these same physicians were enjoying the benefits of personal computing in their personal typing, financial management and entertainment. A demonstration project of mainframe clinical information presented through an IBM PC developed with the IBM consulting group in March 1991 generated sufficient response to fund a pilot project. Using a custom terminal emulator developed by our staff and many of the original text screen presentations from our mainframe applications, we created our first integrated interface. In October 1991 we trained 12 volunteers to use eight PC's in one of our centers. The response was positive enough that in 1992 we trained 236 users and installed 112 PCs. This year we have scheduled the completion of this implementation with an additional 135 new users

and 244 more PCs. In May 1993 we will introduce the fully graphical version of the product written in Visual Basic. We anticipate that this version will reduce the key strokes for system navigation by 50 to 70 percent. In the fourth quarter of 1993 we will introduce our physicians to order entry with automation of the forms processes of Pharmacy, Lab, Radiology and specialty consults. In 1994 we intend to automate the progress note creation process, completing the conversion of the medical staff to a nearly completely computer based outpatient medical record.

MANAGING CHANGE

We have identified three dimensions of change which require attention. The first and most obvious is the technical change which allows us to become increasingly efficient and user friendly. The second involves the organizational changes which are required to take full advantage of the new technology. The final and perhaps most difficult to predict is the cultural change which determines the acceptance of new technology by the users. Opinions abound regarding the best approach to the introduction of change. Our approach was to gradually introduce new functionality to the users. We made no attempt to provide our first product free of blemishes; instead we freely admitted its faults and promised to continuously improve on the product with the help of their suggestions. We also relied on our physicians to sell the product to their more cautious colleagues. Because of the budgetary constraints which didn't permit the delivery of the hardware and training to all at the same time we developed a sense of scarcity and privilege which drove some of our physicians to regret not volunteering in the initial phases of the project.

Technological Changes

We have tried to produce noticeable enhancements to the system at least twice per year. We strive to maintain a climate of change that our physicians will become accustomed to. We hope that this will become a given aspect of the practice environment they work in. The one most enduring feature of our practice will be constant change.

Pilot version: The pilot version was designed to be available on two platforms. The first was the office

based workstation which was an 80386 PC compatible computer with a serial port direct link to the mainframe and a custom terminal emulator written in C which allowed color presentation, mouse commands and the selected use of the clipboard and printing functions of Windows. In addition to Windows we installed Word for Windows. The alternate platform was the existing dumb terminals of the mainframe which numbered in excess of 1500 in all major clinical areas. The initial applications available were limited to Lab, Pharmacy, Appointment history, Referral history, Advice nurse documentation, Patient demographics, Hospitalizations and Encounters history.

The software improved on the existing applications by permitting access to all systems without reentering the user code and patient medical record number for each application. In addition we provided an overview capability which we called "Patient at a Glance" which polled all applications for the two or three most recent entries. This gave the physicians a single page high level view of what was available so that they could pursue the relevant pieces in more detail. Three other services were added to the product to ease the clinical process. First was the ability to maintain a list of patients of significance to the individual physician. This list could be used to enter the patient's medical record number by simply clicking twice on the entry. With this we eliminated the reentry of the nine digit medical record number for patients that the physician was seeing frequently. The second was a file that created reminders for the physician which they managed themselves. The third service involved the ability to create a short note (limited to 13 lines) which would be accessible by others. The purpose of this was to provide some messaging in those circumstances when we could be sure that the written note would not be available within the necessary time range.

Version 1.0: In May of 1992 we began the general release of the system. The dual platform continued to be offered so that those who did not receive a computer would still be able to use the system until we could get them the hardware. We added three new features to the system. The first was the physicians daily schedule which also was capable of automating the medical record number entry process. The second was the transcribed radiology results. The third was the output of our transcription department. This included specialty

consults, pathology reports, and outpatient operative reports.

We installed the devices and provided four hours of hands on training within two weeks of each other, concentrating on one center per month limiting each center to approximately 10 devices.

We gave preference to the primary care departments because they were in the office 40 hours per week and had a high volume of patients with a wide array of information.. At the mainframe we monitored usage by physician, application and patient. We have found that this information has been invaluable in economic justification of the project.

Version 1.2 In August of 1992 we added three additional features. The first was the expansion of the patient list to an unlimited number of lists so that the physicians could organize their patient lists into categories of their choice. The second was to add a problem list. This was a list generated from the hospitalization history and the coded diagnoses of the encounter system. The third addition was the Pap tracking system. At this point we doubled our delivery schedule so that by year end we had distributed 112 PCs . By year end we had also trained 246 users on the system with over 180 of those being Physicians.

Version 2.0 In the last quarter of 1992 we began work on a fully graphical environment. Our goal was to eliminate the unnecessary key strokes involved in returning to the top menu of our system and permit the viewing of information from any of the applications simultaneously. In short we sought the advantages of event driven programming. We have developed an environment in Visual Basic 2.0 which does this. Each mainframe application's information is now available in a separate window and can be selected using a button on a graphical tool bar. You can open any and all windows simultaneously and close all of them with a single click. Adding and deleting patients from the lists involves simple drag and drop gestures. The selected patient's name and address can be sent to the clipboard .

We have also added some requested functionality to the new program. A single button now sends a message to the medical records department requesting the chart. We have a window which contains practice guidelines. Our physician note writing facility has expanded to permit up to 32 pages for a progress note. This provides full

progress note support for those who wish to move to a completely electronic record. These notes can be sorted and selected by date, author or diagnosis. By March 1993 we have reached 100 % participation at our downtown D.C. office with 32 physicians online using work stations.

Organizational Changes

Having physicians access their own electronic information required no organizational change. We estimated that in the past each piece of data required approximately three minutes of a clinic assistant's day to produce. For the physicians the time involved in accessing the data was more than offset by the time they spent waiting for the clinic assistant to finish what they were doing or in some cases the time required in finding the assistant. For the physicians the appeal of being able to act independently on their needs was the major advantage. Moving from simply viewing data to order entry and progress note writing capability will require substantial organizational change. The first impact was felt by the medical records department. Shortly after the introduction of the print capability we found that medical records was receiving paper with clinical data to be added to the chart. Often the paper did not have sufficient patient identifiers or signatures. To the credit of the medical records supervisors they took this unanticipated result in a good natured fashion but we had to quickly adjust the program to assure that any printing automatically included the patient's name and medical record number. The development of order entry capability has required the detailed involvement of the Pharmacy and Lab departments. In setting up the process we have made sure that the process provides benefit to these departments as well as the physician. In return we have secured the promise that the benefits realized by the department will be documented to help in the cost justification of the system. Probably the biggest organizational challenge will come with the implementation of consult tracking. This will require the participation of over thirty service chiefs on an ongoing basis in providing lists of diagnoses and guidelines.

Cultural Changes

Progressive involvement: We established three levels of involvement with the computer in clinical practice. The first is to seek their own information from the computers when they found that they needed something which the chart did not provide or when the chart was not present. The second stage

is to lead them to start their day by consulting the computer for recent information or reminders and messages. The final stage is to incorporate the computer into the processes of each visit so that the physician will be involved with the computer with each action he takes. We feel that until the majority of our physicians are consulting the computer with each encounter we will not be able to reliably support and enhance the care with the alerts and reminders which will ultimately provide the embedded medical knowledge we feel must be a part of our long term strategies.

Physician computer literacy: We conducted an initial survey of our physicians in June 1990, similar to those reported elsewhere.[2-3] The survey revealed that 60% of our physicians had some sort of computer in the home. 69% had at some time learned to touch type. 61 % were using the dumb terminals already though only 38% had their own user codes. 15% admitted being somewhat computer phobic. 96 % expressed a willingness to learn. This year we have finally set in place a literacy program which will assure a minimal level of expertise. We offer eight hours of hands on training devoted to learning Windows and Word for Windows or Word Perfect for Windows. We supplement this with copies of Typing Tutor and Microsoft Productivity Pack. We intend to set expectations for all new hires that they demonstrate proficiency or take the same training prior to being hired. We feel these measures will drive the institution toward being the employer of choice for the computer literate new graduate physician.[4]

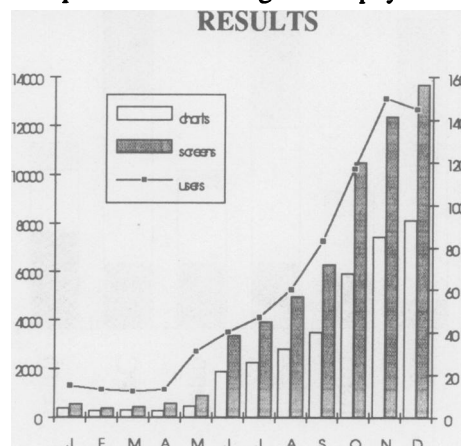


Figure 1. shows that over the course of 1992 we had a dramatic increase in the use of the computers by the physicians. We started the year with the pilot group of 12 physicians examining 391 charts per

month and viewing 567 separate screens of data. We finished the year with 145 physicians examining 8,133 charts and viewing 13,692 screens.

Percent Potential users online

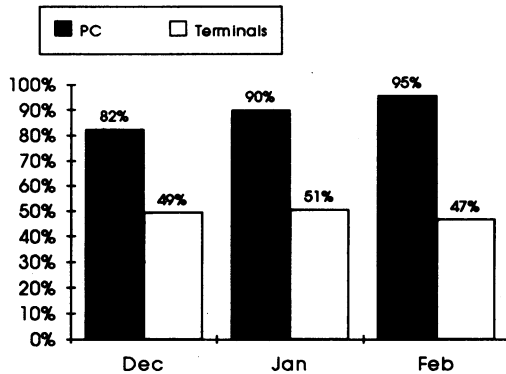


Figure 2. shows that those physicians who were given their own PC's in their office responded well to the training and used the system 82% to 95% of the time with a trend of increasing use. Those physicians offered training without their own PC took advantage of the opportunity 50% of the time or less with no improvement over time.

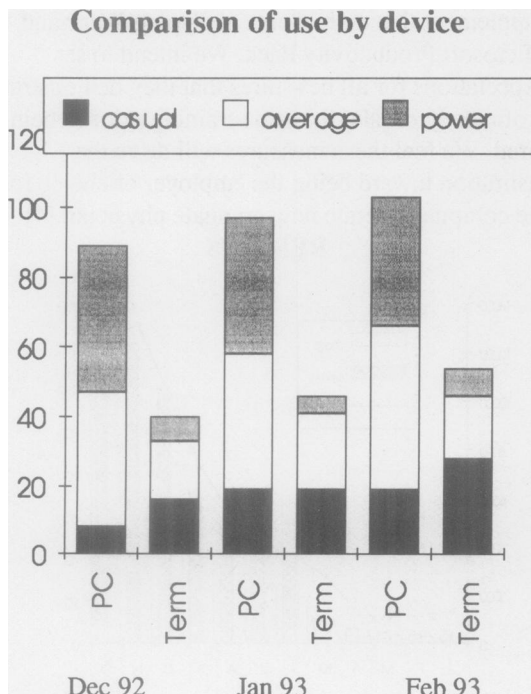


Figure 3. shows the intensity of those using the PCs. Casual use represents less than 20 screens per month. Average use was 20 to 100 screens per month and power users had from 100 to 1000

screens per month. The office volume of these physicians was from 300 to 500 patients per month. We did not correlate the office volume with use but from our data we can infer that the use ranges from 0.2 to 3.0 screens viewed per office visit. During the same time period the figure shows that the physicians using the available terminals in the clinical spaces were fewer and used the machines far less. Only 5 to 10% of these users were accessing more than 100 screens per month. What is reassuring is that although their use was casual it remained consistent suggesting that they were not becoming discouraged. It suggests that we had not achieved an environment which made direct access preferable to clinic assistant help. This may have been because they were competing with the clinic assistant for access to the terminals.

CONCLUSION

The need for a user- friendly interface specifically designed for the physician, has enjoyed widening acceptance[5-7]. The advantages of a graphical presentation have also been stated before[8-12]. We were not surprised to find that our physicians viewed over 100,000 screens of data in their first ten months experience with the program without the assistance of office staff. We feel that we have successfully incorporated the use of computers into the daily work of our physicians. Some questions remain unanswered however. Our implementation did not separate the effect of individual work stations from the effect of the graphic environment and the attractiveness of the color devices and mouse. We feel we have demonstrated that our physicians are willing to embrace the computer in their daily work and that this has led to some efficiencies in the use of our clinic staff. A second major question remains to be answered. Do our physicians differ significantly from those in private practice in terms of age, computer experience or attitude? The following strategies have served us well so far and we intend to continue them.

Voluntary: Voluntary use of computers should be the starting point of any development.

Gradual: It is easier to insinuate yourself into the daily lives of the physicians than to suddenly expect a complete change in practice style.

Supportive: A solid computer literacy plan must accompany the implementation if the physicians are going to accept it. What ever you save on training you will pay for many fold in support and help desk activity.

Collaborative: With almost every new service a number of our physicians had already requested the enhancement prior to its development. Early on this project was held very closely. When we began production the style of the project began to change toward a collaborative effort. The ticket for entry to the development process was a good idea for further enhancement and the willingness to put in time after regular working hours to see it through.

Justify each step: Our organization is very cost conscious. Only in the last year has the region provided a formal method for innovation funding. In order to proceed we had to promise short and long term efficiencies in daily practice. Each new enhancement is now supported with statements regarding the anticipated savings, and where the evidence can be captured these benefits are documented with a snap shot before and after.

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